

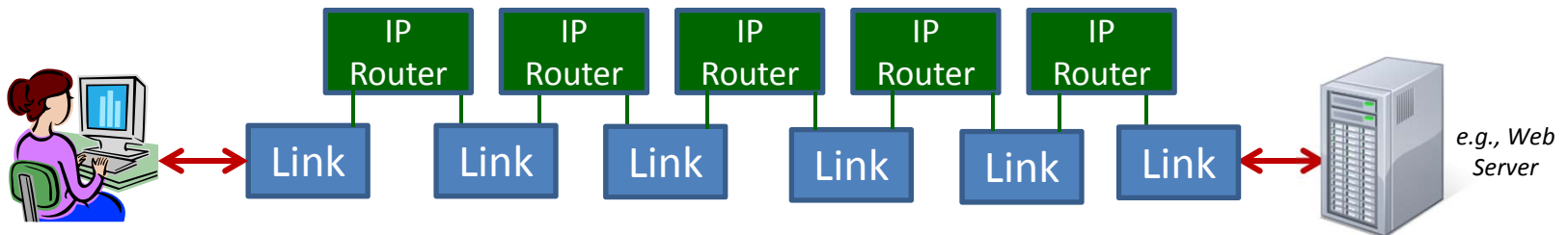


SSCN 13499 - Delay Tolerant Networking (DTN) Overview

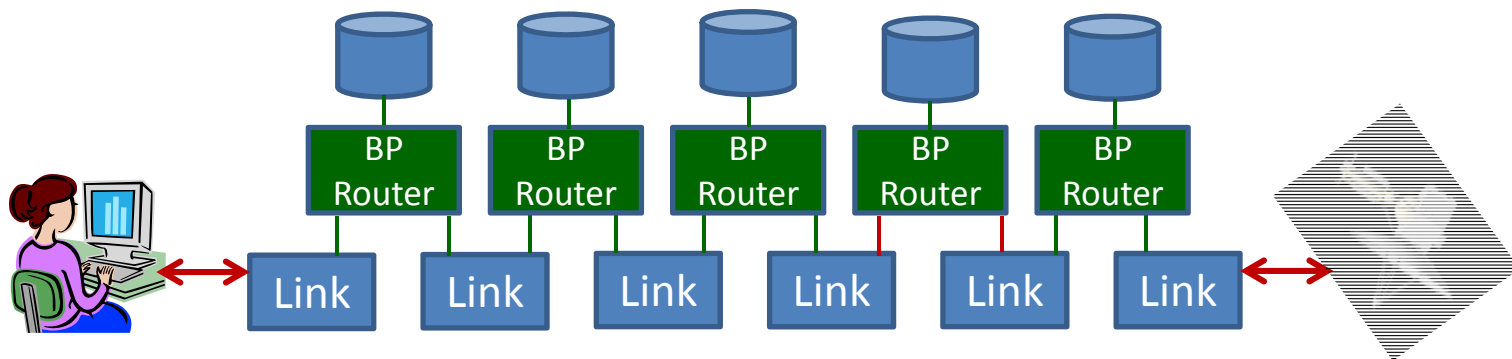
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What is DTN?

- DTN is actually a combination of protocols that are being developed to extend the terrestrial Internet into Low Earth Orbit (LEO) and beyond to help form the Solar System Internet
- The terrestrial Internet works by connecting multiple individual **links** into an end-end path using Internet Protocol (**IP**) routers. The end-end path is always available, delays are short (a few milliseconds) and error rates are very low.



- The “IP” of the Solar System Internet is the Bundle Protocol (**BP**), which is the core of the DTN suite.
- The end-end path is rarely available due to disruptions and outages of individual links and delays are potentially very long (minutes to days) which leads to high error rates.
 - The BP routers work in a store-and-forward mode where data is held until the next hop becomes available.
 - BP often uses “Custody Transfer” to improve network efficiency – a BP router accepts custody of incoming Bundles, thus allowing the previous hop to clear its buffers.

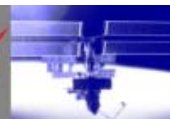


Benefits to payloads



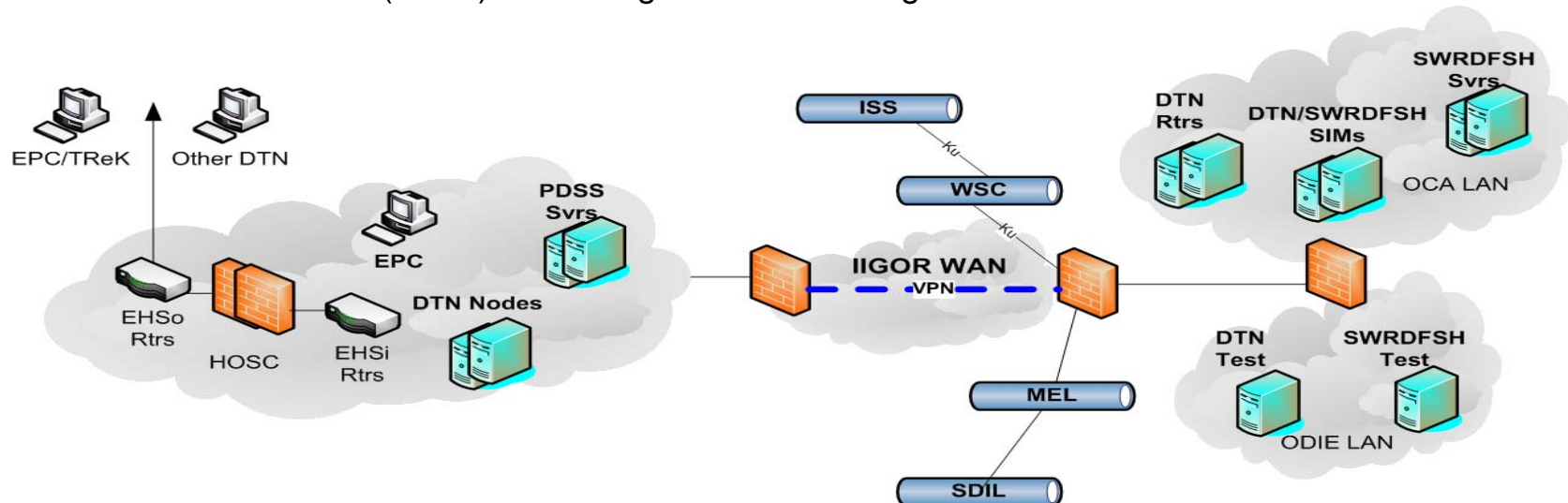
◆ DTN Benefits to Payload Communications:

- Provides capability for Payload Developers (PDs) to automate operations and ensure science delivery with little regard for link or facility outages
 - ✦ HOSC and ISS DTN nodes will store user file uplinks/downlinks and forward bundles as Ku-band becomes available
 - ✦ HOSC DTN node will also store user telemetry and forward it to the PD site when it comes back online
- Reduce PD real-time support to access and downlink science data
 - ✦ DTN stores data during LOS and automatically initiates transfer upon AOS
 - ✦ A download transfer can span Ku-Band AOS periods without any special scheduling or scripting
 - ✦ Reduces need for duplicate storage and extra retrieval actions
- Reliable data transfer for ISS during LOS/AOS cycles
 - ✦ Automatic verification of bundle receipts, retransmissions reduced
 - ✦ When transmission errors occur only the bundles that have errors are retransmitted
 - ✦ Maximizes use of bandwidth by reducing the amount of data that has to be retransmitted
- Allows PDs to use DTN protocols for their own applications (streaming, telemetry, etc.)



MCC, HOSC and SDIL Implementation Ground Architecture

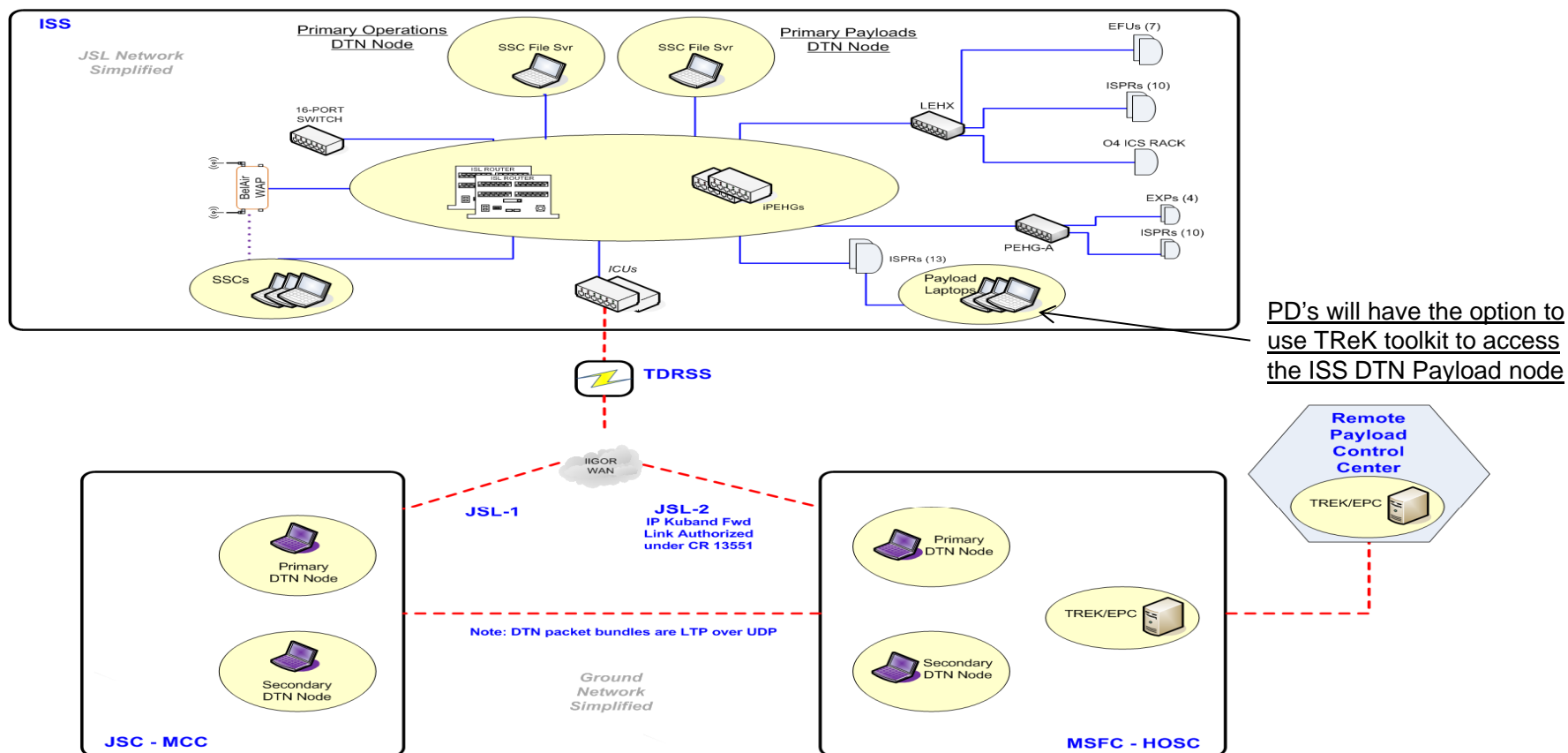
- ◆ HOSC Ground System DTN Architecture includes:
 - Modification to HOSC DTN nodes running DTN2 implementation to communicate with ISS and MCC-H DTN Nodes (Existing resource that supported CGBA DTN operations)
 - New DTN ION enabled version of TReK software (TReK v4.1.0 estimated delivery date 3/31/2015):
 - ◆ ION Wrapper – a utility program to start /stop ION, automatically generate ION configuration files, etc.
 - ◆ Updates TReK CFDP products to work with ION.
 - New Bundle replay capability for the HOSC science archive
 - Leverages network interfaces deployed under CR 13351 Payload Ku-Forward
- ◆ MCC Modifications include:
 - Deploy DTN Nodes in OCA Ops (3) and one in OCA Development and Integration Environment (ODIE) - Leverages OCA 21 design





ISS System Implementation Architecture

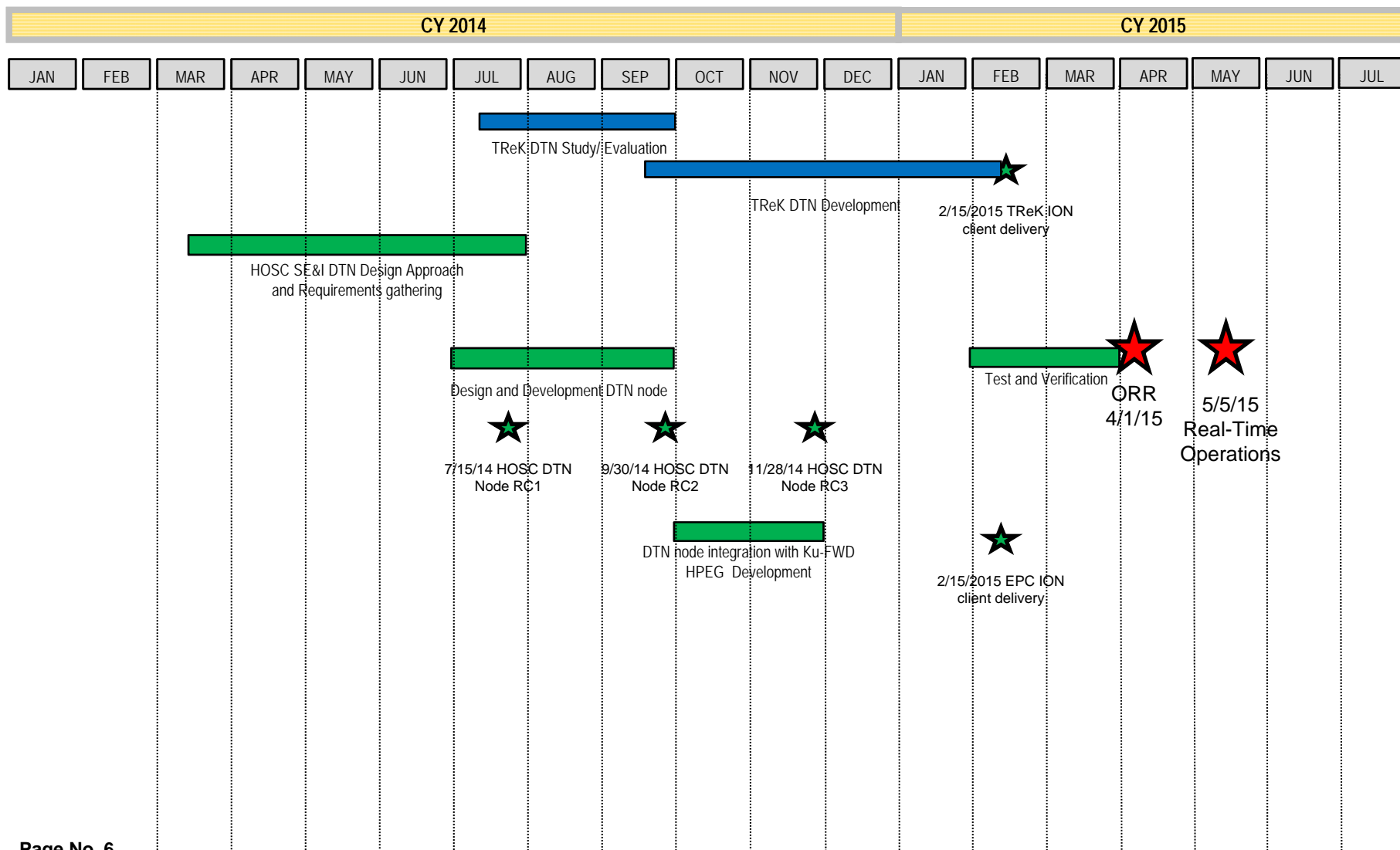
- ◆ ISS DTN Architecture includes:
 - Two DTN nodes using Interplanetary Overlay Network (ION) on an SSC File Server platform
 - ✦ ION is developed by JPL, and maintained by NASA (open source, publically available application)
 - Incorporates DTN capability on SSC and Payload Express Laptops
 - Payload Developers will be able to use the same TReK 4.1.0 software onboard at their Payload to access the ISS DTN institutional service.



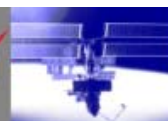
PD's will have the option to use TReK toolkit to access the ISS DTN Payload node



HOSC Schedule



Back-Up Material



DTN Protocol Development

The term “DTN” refers to a [suite](#) of individual space data communications protocols that stack together to support user applications

